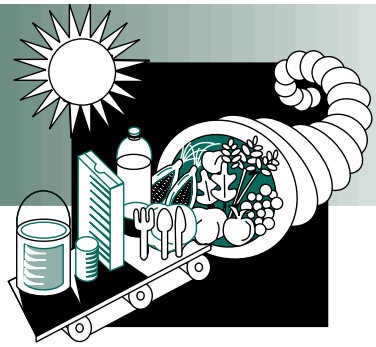
AGRICULTURE

Project Fact Sheet



CATALYTIC UPGRADING OF GLUCOSE

BENEFITS

- Saves significant amounts of energy
- Reduces waste production
- Decreases U.S. dependency on foreign oil
- Adds significant value to the rural farming community
- Extends markets for corn growers and the agriculture industry
- Allows use of existing feedstock infrastructure
- Enhances U.S. competitiveness in agricultural and chemical products
- Potential 2020 target market is 1 billion pounds of polyols per year
- Projected 2020 fossil fuel displacement is 19.1 trillion Btu

APPLICATIONS

The project partners have close ties to both the wet milling and chemical industries and will help integrate these sectors, a requirement for commercial success of the technology. Engineering information from the pilot plant demonstration will help determine the design and cost of a full-scale, commercial plant.

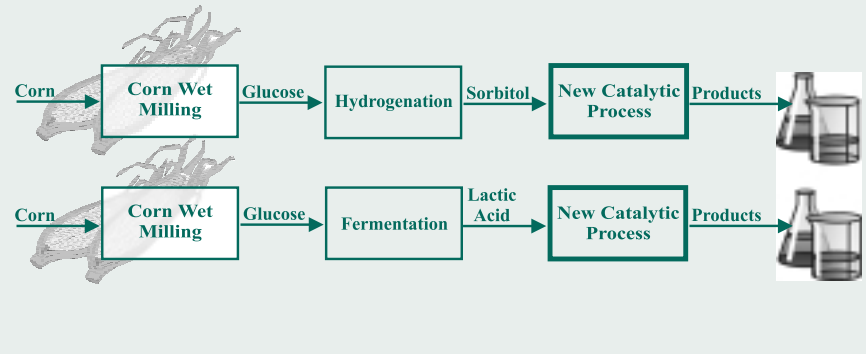
WATER-BASED CATALYTIC PROCESSING OF CORN-DERIVED GLUCOSE WILL OFFER A NEW ROUTE TO COMMODITY CHEMICALS

There is an increasing market for a number of value-added chemicals that can potentially be derived from glucose rather than petrochemicals, such as ethylene and propylene glycol, 1-4 butanediol, and tetrahydrofuran. These chemicals are used to make plastics, antifreezes, and other products. Glucose is readily available as a purified feedstock from corn wet milling today. Other research efforts to obtain glucose even more cost-effectively from other renewable biomass sources, including crop residues, have been going on for some time. This research project will explore two methods for applying catalysis to convert glucose to value-added chemical products. The project has the potential to add significant value to the rural farming community, while at the same time reducing the use of fossil fuel.

Researchers will conduct a project to synthesize and characterize appropriate catalysts and determine the process economics of converting the feedstock glucose to new products. In the first approach, the development will be directed at the catalytic production of propylene glycol from sorbitol. Sorbitol can be effectively produced through the hydrogenation of glucose. In the second approach, the development will be directed at the catalytic production of propylene glycol from lactic acid. Lactic acid can be effectively produced through fermentation with glucose.

Total energy requirements for the proposed technology are projected to fall by more than 65 percent in a 100-million-pound, glucose-based plant when compared to the current method for producing propylene glycol from petrochemicals. Moreover, almost all the energy for the new process can be derived from biomass or waste materials. In addition, the glucose-based process will have less impact on the environment than current processes.

CHEMICALS FROM GLUCOSE



Researchers are exploring new catalysts to convert glucose to valuable chemical products.

Project Description

Goal: To develop economically viable catalytic processes for producing value-added chemicals from glucose derived from corn.

In Phase 1 of this project, novel catalysts will be developed and characterized for hydrogenation and hydrogenolysis. Pacific Northwest National Laboratory will analyze the reaction sequence in an aqueous media, using the model of the aqueous phase catalytic hydrogenation of sorbitol to propylene glycol. Analysis of the process economics will begin and continue throughout the research effort. Phase 2 will focus on optimizing the catalysts developed in Phase 1, on gaining an understanding of the reaction pathways through efforts at Michigan State University, and on developing catalysts for the conversion of lactic acid to propylene glycol. In Phase 3, the optimized processes and catalysts will be scaled up for use in a pilot plant. The product sample will be produced and engineering information will be derived from the demonstration for designing a full-scale plant and estimating its costs.

Progress and Milestones

The following milestones will be accomplished:

- At the end of Phase 1, a "go/no go" decision will be based on the process economics and commercialization assessment.
- At the end of Phase 2, a "go/no go" decision will also be based on the process economics and commercialization assessment.
- Following the pilot plant demonstration in Phase 3, the process economics and cost estimate for the commercial plant will be refined.

Project Partners

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National Corn Growers Association
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Pacific Northwest National Laboratory
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